

NON-PUBLIC?: N  
ACCESSION #: 9309280047  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Surry Power Station, Unit 2 PAGE: 1 OF 6

DOCKET NUMBER: 05000281

TITLE: Unit 2 Turbine-Generator Trip Via the Loss of Field Relay  
EVENT DATE: 08/23/93 LER #: 93-004-00 REPORT DATE: 09/20/93

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 97.5

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:

50.73(a)(2)(i)(b) & 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: M. R. Kansler, Station Manager TELEPHONE: (804) 357-3184

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: TL COMPONENT: PSD MANUFACTURER: W120  
REPORTABLE NPRDS: Yes

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 0519 hours on August 23, 1993, with Unit 1 at 100% power and Unit 2 at 97.5% power, the Unit 2 reactor tripped due to a turbine - generator trip. Control room operators promptly initiated the appropriate emergency operating procedures. The reactor was placed in a stable, Hot Shutdown condition. The turbine-generator trip was caused by a loss of excitation field for the main generator due to a component failure in the voltage regulator (VR). During troubleshooting of the VR, a failed phase shifter card was discovered and replaced. As an additional precaution, two other cards were replaced along with the fuses between the field breaker and the firing circuit drawer. Following the trip, a fire watch notified the Shift Supervisor that sliding Fire Door 18 had shut. As a result, he could not complete his fire watch rounds of the Unit 1 Emergency Switchgear Room (ESGR) at 0523 hours, in accordance with Technical Specification 3.21. This fire door separates Unit 1 and 2 ESGRs. Following stabilization of Unit 2, an operator was dispatched and the sliding fire door was opened and relatched.

During this event the health and safety of the public were not affected. This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv) and 10 CFR 50.73(a)(2)(i)(b).

END OF ABSTRACT

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## 1.0 DESCRIPTION OF THE EVENT

At 1245 on August 21, 1993, the control room operators received a Unit 2 main generator low voltage alarm. Concurrently, 30 MWe swings were noted on the generator output megawatt chart recorder. An operator was dispatched to locally monitor the excitation switchgear cabinet EIIS-TL-SWGR!. Electrical Maintenance and the System Operator (SO) were notified. The SO informed the Unit's Senior Reactor Operator (SRO) that there were no known system disturbances on the 500 KV circuit that could be causing the transient. At that time, exciter voltage and amperage were varying from approximately 10 to 70 volts/amps from a nominal 60 volts/amps. The permanent magnet generator EIIS-TL-PMG! (PMG) supply voltage was also observed to be oscillating. The Unit 2 main generator VR EIIS-TL-RG! was subsequently placed on base adjuster control (manual control) and no further alarms or megawatt swings were observed. A check by the electricians for blown fuses in the exciter diode wheel revealed no problems. On August 22, 1993, with the VR's auto regulator off and with excitation being controlled by the base adjuster only, no fluctuations in the main generator or PMG output were noted.

At 0217 hours on August 23, 1993, main generator reactive power (measured in MVARS) and Virginia Power system voltage were observed fluctuating. Virginia Power system voltage had changed from 500 KV to 530 KV and main generator EIIS-TB! MVARS from -35 (in) to +200 (out). Using the base adjuster, the reactor operator adjusted main generator output to reduce the generator excitation field thereby restoring voltage to 22 KV.

At 0519 hours on August 23, 1993, with Unit 1 at 100% power and Unit 2 at 97.5% power, the Unit 2 reactor tripped due to a turbine - generator trip EIIS-TA-TRB!. The turbine - generator trip was caused by a generator differential lockout relay (86G relay) actuation caused by actuation of the loss of field relay (KLF relay). Actuation of the KLF relay picks up the lockout relay 86G which trips the exciter field breaker (41 breaker), the generator output breakers, the Station service normal supply breakers, the main stop valves, and the main

turbine.

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Control room operators promptly initiated the appropriate emergency operating procedures. The reactor trip breakers EIIS-JC-BKR! were verified open and control rods EIIS-JD-ROD! were verified inserted into the core. The Auxiliary Feedwater Pumps EIIS-BA-P! started as designed on Lo-Lo Steam Generator Level signal. The Anticipated Transient Without Scram Mitigation System Actuation Circuitry (AMSAC) armed and initiated as designed. Decay heat was removed by the main steam dump valves EIIS-SB-PCV! to the main condenser. The Individual Rod Position Indicator (IRPI) M-10 rod bottom light was slow in illuminating. Minimum Reactor Coolant System (RCS) EIIS-AB! temperature during the transient was approximately 530 degrees F. A shutdown margin calculation verified that the shutdown margin was acceptable at 530 degrees F.

After the trip, a fire watch notified the Shift Supervisor that sliding Fire Door 18 had shut. As a result, he could not complete his fire watch rounds of the Unit 1 ESGR at 0523 hours, in accordance with Technical Specification 3.21. This fire door separates Unit 1 and 2 ESGRs. Following stabilization of the Unit, an operator was dispatched to open and relatch the sliding fire door. Fire Door 18 was opened at 0615.

In accordance with 10CFR50.72(b)(2)(ii), a 4-hour Non-Emergency report to the NRC operations center was made at 0908 hours due to the Reactor Protection System (RPS) actuation. Additionally, a State Department of Emergency Services (DES) Non-Emergency notification was made at 0910 hours.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv) and 10 CFR 50.73(a)(2)(i)(b).

## 2.0 SAFETY CONSEQUENCES AND IMPLICATIONS

Upon receipt of the reactor trip, RPS actuation functioned as designed and all control rods inserted into the core. Station operating personnel promptly placed the plant in a stable, Hot Shutdown condition in accordance with the proper procedures. The shutdown margin of reactivity was calculated and found to be satisfactory. Unit 1 ESGR fire

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detection and fire suppression systems were available and operable. After stabilizing the unit at Hot Shutdown, operators promptly relatched Fire Door 18 and the continuous fire watch coverage was resumed. The health and safety of the public were not affected by this event.

### 3.0 CAUSE

The reactor tripped due to a turbine - generator trip. The troubleshooting and root cause investigation for the trip determined that the turbine - generator trip was caused by an intermittent failure of a phase shifter card in the firing circuit of the main generators voltage regulator. The phase shifter card output regulates the excitation field of the generator. A low output from the phase shifter card results in a continuous gate signal to the thyristor circuits which provide current for the main generator excitation field. This continuous gate signal to the thyristors increases the current sent to the exciter field. The increased current overexcites the generator and results in a high generator output voltage.

The phase shifter card intermittent low output caused the Unit 2 voltage and reactive power fluctuations, and the power increase experienced while in VR base adjuster operation at 0217 hours on August 23, 1993. The actions taken by the operator to correct the overexcited condition took the base adjuster close to its lower limit by reducing main generator excitation. At 0519 hours on August 23, 1993, with the base adjuster close to the lower limit, the phase shifter card returned to its normal output value. (The intermittent problem cleared.) This resulted in less current to the exciter field causing the exciter field to decay to the loss of field setpoint actuating the KLF relay.

### 4.0 IMMEDIATE CORRECTIVE ACTION(S)

Following the reactor trip at 0519 hours on August 23, 1993, control room operators initiated the appropriate emergency operating procedures. The reactor trip breakers were verified open and control rods were verified inserted into the core.

The Shift Technical Advisor monitored the critical safety function status trees to ensure that plant parameters remained within safe bounds.

After the trip, a fire watch notified the Shift Supervisor that sliding Fire Door 18 had shut. As a result, he could not complete his fire watch rounds of the Unit 1 ESGR at 0523 hours, in accordance with Technical Specification 3.21. This fire door separates Unit 1 and 2 ESGRs. Following stabilization of the Unit, an operator was dispatched to open and relatch the sliding fire door. This fire door closes by activation of the halon system, the smoke detector alarm, or the manual release pushbutton. The halon system had not discharged nor were the smoke detectors in alarm. The door closure was spurious. Fire Door 18 was opened at 0615, and the fire watch coverage in the Unit 1 ESGR was reestablished.

The minimum RCS temperature during the transient was approximately 530 degrees F. A shutdown margin calculation verified that the shutdown margin was acceptable at 530 degrees F.

A root cause investigation of this trip was initiated including plans for troubleshooting of the main generator VR by the vendor.

#### 5.0 ADDITIONAL CORRECTIVE ACTION(S)

Troubleshooting of the Unit 2 main generator voltage regulator by the vendor between August 23, 1993 and August 25, 1993 discovered a failed phase shifter card in the firing circuit. The phase shifter card was replaced. As an additional precaution, the excitation dampening and voltage error cards were replaced along with the fuses between the field breaker and the firing circuit drawer.

The IRPI M-10 rod bottom light was slow in illuminating. This condition has been observed during previous Unit 2 trips from "at power" conditions. The Nuclear Steam Supply System vendor was recently requested to re-evaluate this condition and confirmed that the condition is an indication problem. The cause of the problem is associated with the permeability (magnetic properties) of either the control rod M-10 pressure housing or its control rod driveline. Control rod M-10 has been evaluated as operable based on control rod drop testing.

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#### 6.0 ACTIONS TO PREVENT RECURRENCE

A review of voltage regulator performance will be undertaken to determine whether any additional actions are required to enhance reliability. In addition, Engineering is investigating spurious closure of Fire Door 18. Appropriate corrective measures identified

by the investigation will be implemented. Engineering is also investigating if effective actions can be undertaken to correct the control rod M-10 IRPI indication problem.

## 7.0 SIMILAR EVENTS

LER 2-89-009-00, "Turbine Trip/Reactor Trip Due to 86 BU Trip Caused by Spurious Actuation of KD-41 Relay"

## 8.0 MANUFACTURER/MODEL NUMBER

Phase Shifter Card Manufacturer Westinghouse  
Model S588C625G03

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10CFR50.73

Virginia Electric and Power Company  
Surry Power Station  
P. O. Box 315  
Surry, Virginia 23883

September 20, 1993

U. S. Nuclear Regulatory Commission Serial No.: 93-606  
Document Control Desk SPS:JDK  
Washington, D. C. 20555 Docket No.: 50-281  
License No.: DPR-37

Dear Sirs:

Pursuant to Surry Power Station Technical Specifications, Virginia Electric and Power Company hereby submits the following Licensee Event Report applicable to Surry Power Station Unit 2.

## REPORT NUMBER

50-281/93-004-00

This report has been reviewed by the Station Nuclear Safety and Operating Committee and will be forwarded to the Management Safety Review Committee for its review.

Very truly yours,

M. R. Kansler  
Station Manager

Enclosure

cc: Regional Administrator  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

M. W. Branch  
NRC Senior Resident Inspector  
Surry Power Station

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